

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
SPECIFICATIONS FOR THE PURCHASE OF
GROOVED BRONZE TROLLEY WIRE
80% CONDUCTIVITY

(5 PAGES)

Spec. P-102
REVISION C

(Supersedes Spec. EE-772)

February 15, 2017

These specifications cover the purchase of 4/0, 3/0 and 2/0 A.W.G. Grooved Bronze Trolley Wire (Conductivity 80%).

SECTIONS:

The standard sections shall conform to that designated in paragraph 9 (a) of ASTM Specifications B9 (latest revision).

MATERIAL:

Material shall be bronze, of copper magnesium composition (See attached Appendix), alloy 80; using only high conductivity copper.

DIMENSIONS & PERMISSIBLE VARIATIONS:

Dimensions shall be as specified in Fig. 1 of ASTM Specification B9 (latest revision).

<u>TABLE 1</u>			
Size A W .G.	Nominal Area, Cir. Mils	Area, Sq. In.	Calculated weight, lbs. per mile
4/0	211,600	0.1665	3389
3/0	167,800	0.1314	2674
2/0	137,900	0.1083	2205

Weight of the trolley wire shall not vary more than four (4%) per cent over or under the weights above specified.

QUALITY:

Wire must be symmetrical and of uniform size throughout, uniform in quality, free from scale, flaws, splits, pipes, and other defects, and the surface smooth and free from scratches.

TENSILE STRENGTH & ELONGATION:

Wire shall be so drawn that its tensile strength and elongation shall not be less than that specified in Table II.

TABLE II

Size A W .G.	Nominal Area Cir. Mils	Tensile Strength lbs. per Sq. In. (min.)	Elongation in 10 inches, per cent (min.)
4/0	211,600	67,000 \pm 4000 PSI	3.25
3/0	167,800	67,000 \pm 4000 PSI	2.75
2/0	137,900	67,000 \pm 4000 PSI	2.25

The speed of the moving head in the Testing Machine shall not be more than 3 inches per minute during the test.

TWIST TEST:

A sample shall be taken from any part of a reel and tested in a testing machine in which the grips are ten (10) inches apart and in which there is a free linear motion of the tailstock in respect to the head. The torsion shall be applied not faster than ten (10) turns per minute. Sample shall be twisted to destruction and shall not reveal under test any seams, pits, slivers or surface imperfections or sufficient magnitude to indicate inherent defects or imperfections in the wire. At the time of fracture, the wire shall be twisting with reasonable uniformity. All samples shall withstand at least three (3) twists without breaking.

JOINTS:

Necessary joints in trolley wire must be made in accordance with the best commercial practice as noted below, and tests upon a section of wire containing a joint must show at least 90% of the values in Table II. Joints (splices) shall be resistance brazed with silver solder. Butt resistance welding may be permitted but must not subject joints to any degree of porosity.

Elongation tests shall not be made on specimens containing joints.

RESISTIVITY:

Electric resistivity shall be determined on fair samples by resistance measurements. At a temperature of 20°C (68°F) the resistivity shall not exceed 1094 ohm-pound/mile².

DENSITY:

For the purpose of calculating weights, cross sections, etc., the density of the bronze shall be taken as 8.89 grams per cubic centimeter (0.321 lbs. per cu. in.) at 20°C (68°F).

SHIPMENT:

The wire shall be shipped on substantial reels suitable for the weight and size of the wire to be handled. The reel rims shall be of such diameter as to allow sufficient clearance between them and the wire to prevent any damage to the wire when the reels are rolled about, and shall be of sufficient strength to prevent bulging.

The diameter of the reel rims shall be 46 inches.

The maximum length of the reel along the axis, measured over all projections from the reel rim, shall not exceed 29 inches. The Cable Reel shall be Wood.

The inner end of the wire shall be securely fastened to the reel (wood) so that it will not loosen when the inner layers of wire are being removed during installation.

As shown in Fig. 1, ASTM B9, the diameter along which dimension "B" is measured shall be considered as the vertical axis of the wire.

The wire shall be wound on the reel without crosses, with the small lobe of the wire on the outside of the reel, and so that the perpendicularity of the vertical axis of the wire to the axis of the reel is approximately constant; a maximum deviation of 5° on either side is acceptable. The wire shall be wound on the reel in such a manner that the wire will not come in contact with the reel bolts or any other metallic parts of the reel.

Each disc or head of the reel shall be provided with an iron plate or cast iron bushing, in the center of which there shall be a circular hole not less than 2-1/8" in diameter. The plates or bushings shall be fastened to the head of the reel by means of bolts through the head.

Each reel shall be marked with the Gross, Net, and Tare weights .

REJECTION:

The failure of any sample to meet the above requirements will be sufficient cause for the rejection of the reel .

The failure in the foregoing respects of 30% of the number of reels received in any shipment will be deemed sufficient cause for the rejection of the whole shipment .

The right to reject any or all bids is reserved.

INSPECTION:

The completed wire is to be inspected by a representative of the Authority .

GENERAL:

Except where variances are shown in this specification, wire shall conform in all respects to ASTM Specification B9 (latest revision) .

Deputy Director
Power Systems

PART 2 - PRODUCTS**2.1 TROLLEY WIRE**

- A. The trolley wire shall be No. 4/0 AWG grooved alloy 80 Magnesium bronze trolley wire (minimum conductivity 80%) in accordance with MBTA Specification P-102C, except as modified herein, which is included as Appendix to this MBTA Specification P-102C.
- A. CuMg 0.2 Copper Trolley (Contact) Wire shall be grooved and comply with ASTM B 9.
- B. The wire shall be manufactured from a Copper Magnesium alloy with the following metal composition percent by mass:
- | | | | |
|-----|----------------|-------------|---------|
| (1) | Magnesium (Mg) | Max 0.3 | Min 0.1 |
| (2) | Phosphorus (P) | ≤0.01 | |
| (3) | Others | ≤0.1 | |
| (4) | Remainder | Copper (Cu) | |
- C. Joints in the finished wire shall not be permitted.
- D. Grooved CuMg 0.2 trolley wire shall incorporate identification markings in accordance with the stamped or etching methods of IEEE 1896 – 2016 sections 5.2 Stamping or 5.3 Etching only.
- E. Tensile properties of CuMg 0.2 shall meet or exceed the requirements of ASTM B.9.
- F. Electrical Conductivity @ 20°C shall be equal to or greater than 80%.
- G. Testing shall be in accordance with ASTM B 9.